

## **APPENDIX E**

**Relative Risk Site Evaluation Concept Fact Sheet**

**Relative Risk Question-and-Answer Fact Sheet**

**Briefing Charts for Presentation/Training**

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Office of the Deputy Under Secretary of Defense  
(Environmental Security)

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## **Defense Environmental Cleanup Program Fact Sheet**

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### **The Relative Risk Site Evaluation Concept**

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#### **Introduction**

The Department of Defense (DoD) considers environmental restoration as an integral part of its daily mission activities. At installations around the country, environmental restoration activities are underway to address contamination resulting from past DoD operations. Environmental analysis and cleanup activities address a wide variety of sites contaminated with fuels, solvents, chemicals, heavy metals, and common industrial materials.

Given the large number of sites to be addressed and limitations on money and people to work on these sites each year, DoD believes that a risk-based approach should be applied to work sequencing at active military installations, Base Realignment and Closure (BRAC) installations, and formerly used defense properties using relative risk as a key factor. The relative risk site evaluation framework described in this fact sheet provides a means of helping accomplish this objective.

The framework for evaluating site relative risk was published in September 1994, in the *Relative Risk Site Evaluation Primer (Interim Edition)* which contained instructions for performing relative risk site evaluations at sites across DoD. A revised edition of the Primer was issued in June 1996.

#### **Definition of Relative Risk Site Evaluation**

The relative risk site evaluation framework is a methodology used by all DoD Components to evaluate the relative risk posed by a site in relation to other sites. It is a tool used across all of DoD to group sites into high, medium, and low categories based on an evaluation of site information using three factors: the contaminant hazard factor (CHF), the migration pathway factor (MPF), and the receptor factor (RF). Factors are based on a quantitative evaluation of contaminants and a qualitative evaluation of pathways and human and ecological receptors in the four media most likely to result in significant exposure groundwater, surface water, sediment, and surface soils. A representation of this evaluation concept is presented in Figures 1 and 2. Figure 1 also depicts possible opportunities for stakeholder input into the technical evaluation.

The relative risk site evaluation framework is a qualitative and easy to understand methodology for evaluating the relative risks posed by sites and should not be equated with more formal risk assessments conducted to assess baseline risks posed by sites. It is a tool to assist in sequencing environmental restoration work (i.e., known requirements such as remedial investigation or cleanup actions) to be done by a DoD Component. It is designed to handle the broad range of sites that exist at DoD installations and the broad range of data available. The grouping of sites into high,

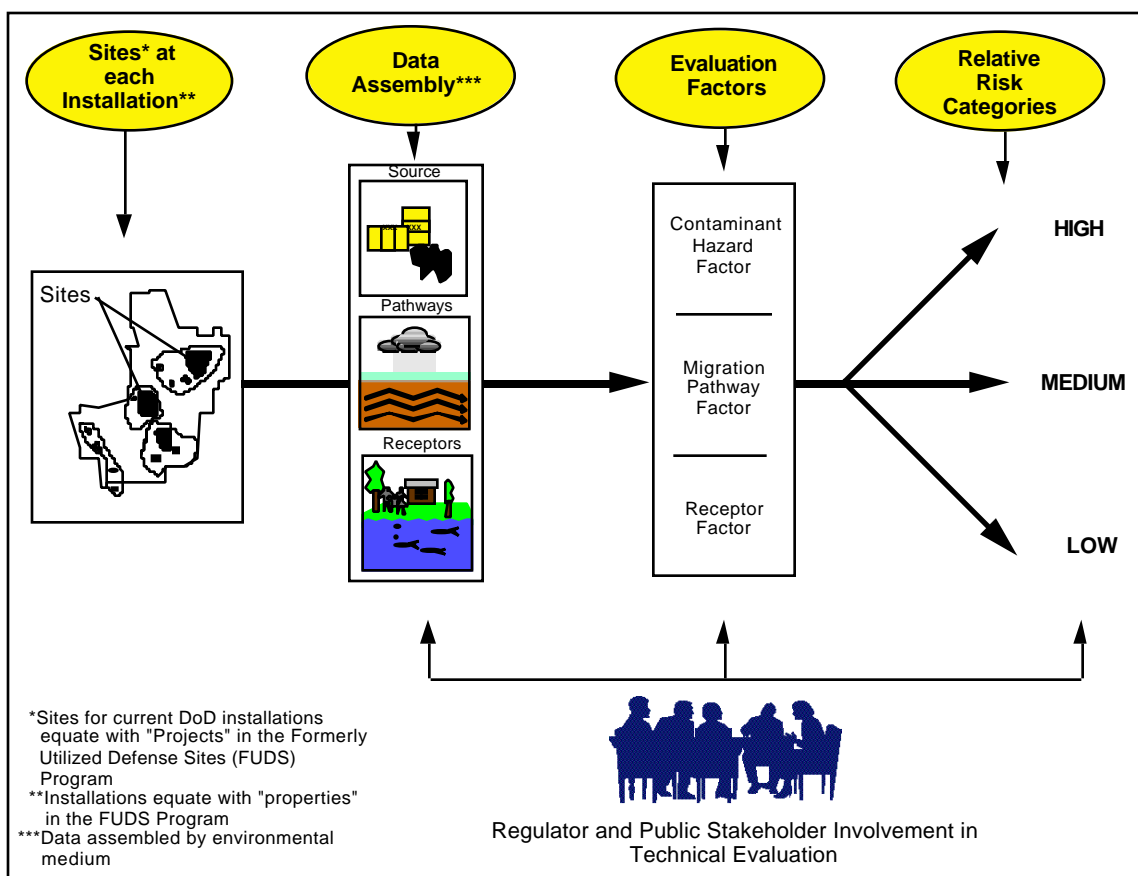


Figure 1. Relative Risk Site Evaluation Concept Summary

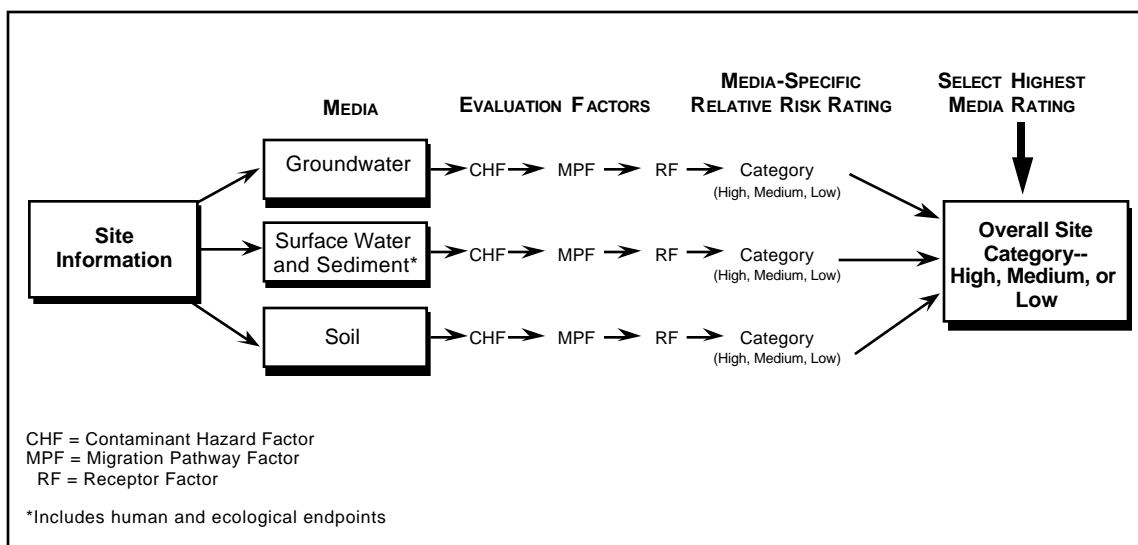


Figure 2. Flow Diagram of the Relative Risk Site Evaluation Framework

medium, or low relative risk categories **is not** a substitute for either a baseline risk assessment or health assessment; **it is not** a means of placing sites into a Response Complete/No Further Action category; and **it is not** a tool for justifying a particular type of action (e.g., the selection of a remedy).

Use of the relative risk site evaluation framework is restricted to environmental restoration sites and does not extend to unexploded ordnance (UXO) removal, building demolition/debris removal (BD/DR), potentially responsible party (PRP) activities, or compliance activities.

### **Relative Risk and Funding Decisions**

Relative risk is not the sole factor in determining the sequence of environmental restoration work, but it is an important consideration in the priority setting process. It should be factored into all priority setting decisions, and should be discussed with regulators and public stakeholders in the environmental restoration process.

The actual funding priority for a site is identified after relative risk information is combined with other important risk management considerations (e.g., the statutory and regulatory status of a particular installation or site, public stakeholder concerns, program execution considerations, and economic factors). These additional risk management considerations can result in a decision to fund work at a site that is not classified as a high relative risk. DoD Components have each developed guidelines for combining relative risk and risk management considerations as part of their planning, programming, and budgeting process.

The relative risk site evaluation framework does not address the question of whether work is necessary at a site; it only provides information for use in helping to determine the general sequence in which sites will be addressed. At the DoD headquarters level, it also provides a framework for planning, programming,

and budgeting requirements, a topic discussed below.

### **Requirements for Relative Risk Site Evaluations**

Relative risk site evaluations are required for all sites at active military installations, BRAC installations, and formerly used defense properties that have future funding requirements that are not classified as (1) having “all remedies in place,” (2) “response complete,” (3) lacking sufficient information, or (4) abandoned ordnance. These four situations are discussed in the following four paragraphs.

Relative risk site evaluations are not required (NR) for sites classified as having all remedies in place (RIP) even though they may be in remedial action operation (RAO) or long-term monitoring (LTM). A RIP determination requires that remedial action construction is complete for a site.

Relative risk site evaluations are not required (NR) for sites classified as response complete (RC). Sites classified as RC are those where a DoD Component deems that no further action (NFA) is required with the possible exception of LTM. An RC determination requires that one of the following apply: (1) there is no evidence that contaminants were released at the site, (2) no contaminants were detected at the site other than at background concentrations, (3) contaminants attributable to the site are below action levels used for risk screening, (4) the results of a baseline risk assessment demonstrate that cumulative risks posed by the site are below established thresholds, or (5) removal and/or remedial action operations (RAOs) at a site have been implemented, completed, and are the final action for the site. Only LTM remains.

Relative risk site evaluations should be based on the information currently available on contaminants, migration pathways, and receptors. Sites lacking sufficient information for the conduct of a

relative risk site evaluation should be given a “Not Evaluated” designation and should then be programmed for additional study, a removal action if warranted, or other appropriate response action, including deferral, before they are evaluated.

Sites comprised solely of abandoned ordnance are not subject to the relative risk site evaluation described in this Primer. Such sites should be evaluated using a separate risk procedure, which is discussed in the management guidance cited above (Office of the Under Secretary of Defense [Environmental Security], 1994).

### **Implementation of the Relative Risk Site Evaluation Framework**

DoD’s goal is to conduct relative risk site evaluations at the field level with the involvement of the regulators and public stakeholders (see Figure 1). The technical evaluation of sites using the evaluation framework can serve as a basis for discussion and negotiation with regulators and public stakeholders. In particular, regulators and public stakeholders can help identify receptors, and can make judgments about the extent of contaminant migration in various environmental media at a site. Where they exist, Restoration Advisory Boards (RABs) are an excellent forum for obtaining public stakeholder input on these aspects of site relative risk. Other opportunities for public stakeholder involvement may also be appropriate. Regulators and public stakeholders should always be given the opportunity to participate in the development and review of relative risk site evaluation data before the data is used in planning and programming.

### **Management Uses of Relative Risk Information**

DoD and DoD Components are using the relative risk site evaluation framework as a tool to help sequence work at sites and as a headquarters program management tool. As a program management tool, the framework is being used by DoD and DoD Components to periodically identify the distribution of sites in each of three

relative risk categories—high, medium, and low. A series of discrete relative risk site evaluations provides headquarters program managers with a macro-level view of changes in relative risk distributions within DoD over time.

The relative risk site evaluation framework and resulting data also provide DoD with a basis for establishing goals and performance measures for the environmental restoration program. In this regard, DoD has established goals for all DoD Components to reduce relative risk at sites in Defense Environmental Restoration Account (DERA) and BRAC programs or to have remedial systems in place where necessary for these sites, within the context of legal agreements. DoD and DoD Components are tracking progress towards these relative risk reduction goals as one of several program measures of merit (MOMs) at the headquarters level. Another MOM tracks the number of sites where cleanup action has been taken and relative risk has been reduced in one or more media. Resultant information is used to provide the necessary feedback to develop and adjust program requirements and budget projections, as well as to assess whether established goals reflect fiscal reality.

### **For More Information**

At the Installation, contact

At DoD Headquarters, contact the Office of the Deputy Under Secretary of Defense (Environmental Security - Cleanup) at 703/697-7475.



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### **Relative Risk Site Evaluation Questions & Answers**

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**Q.1** *How is relative risk information being used by the Department of Defense (DoD) and military services at the field and headquarters levels?*

- A.** Field activities within the DoD use relative risk information as one means of representing the status of their environmental restoration program to DoD, regulators, and local stakeholders. Information on site relative risk is used by each military installation or formerly used defense site, in conjunction with other risk management considerations, to help sequence work at sites in light of available resources within DoD.

Headquarters environmental restoration program offices within each military service collect relative risk information from each field activity to identify to Congress, regulators, and other stakeholders the distribution of sites in each of three relative risk categories—high, medium, and low. A series of discrete relative risk site evaluations provides headquarters program managers with a macro-level view of changes in relative risk distributions within DoD over time. In the event of budget cuts or recessions, Headquarters Program Offices will consider the relative risk of sites along with other risk management considerations in the resultant deferral of projects. In general, low relative risk sites will be deferred before medium relative risk sites, and

medium relative risk sites will be deferred before high relative risk sites. At the installation or field level, specific work program adjustments will be made considering relative risk and other risk management concerns in the event that budget cuts or recessions occur.

Relative risk information will also be used to provide DoD with a basis for establishing goals and performance measures for the environmental restoration program. In this regard, DoD has established goals for all DoD Components to reduce relative risk at sites or to have remedial systems in place where necessary for these sites, within the context of legal agreements. Military services and DoD will track changes in relative risk towards these relative risk reduction goals as a measure of merit (MOM). Relative risk will not be used to set cleanup standards, nor will it be used as a basis for making remedial action decisions, remedy selection decisions, or no further action decisions.

**Q.2** *How are other risk management considerations taken into account for priority setting?*

- A.** Relative risk is not the sole factor in determining the sequence of environmental restoration work, but it is an important consideration in the priority setting process. It should be

factored into all priority setting decisions, and should be discussed with regulators and public stakeholders in the environmental restoration process.

The actual funding priority for a site is identified after relative risk information is combined with other important risk management considerations (e.g., the statutory and regulatory status of a particular installation or site, public stakeholder concerns, program execution considerations, and economic factors). These additional risk management considerations can result in a decision to fund work at a site that is not classified as a high relative risk. Military services have each developed guidelines for combining relative risk and risk management considerations as part of their planning, programming, and budgeting process.

**Q.3** *What is the role of the community in evaluating relative risk at sites?*

- A.** Community members of Restoration Advisory Boards and other members of the public participate in the technical evaluation of relative risk at a variety of levels depending on their desire for involvement. At some installations and formerly used defense sites, community members have received relative risk training and participate directly in the evaluation of relative risk factors for each environmental medium at a site. At other installations and formerly used defense sites, community members review and provide input into relative risk evaluations prepared by installation personnel. DoD intends to increase community input into relative risk evaluations at all installations and formerly used defense sites where there is sufficient interest. To increase community awareness of and access to guidance on performing relative risk site evaluations, DoD has placed the

*Relative Risk Site Evaluation Primer* on the DoD Environmental Restoration Electronic Bulletin Board, a World Wide Web site at <http://www.dtic.dla.mil/envirodod/envdocs.html>.

**Q.4** *What is the role of regulatory agencies in evaluating relative risk at sites?*

- A.** State and federal regulatory agency personnel are key participants in the relative risk evaluation process. Their involvement in this process largely depends on their degree of involvement in an environmental restoration program at a particular installation or formerly used defense site. At some installations or formerly used defense sites, regulatory agency personnel have received relative risk training and participate directly in the evaluation of relative risk factors for each environmental medium at a site. Discussions with regulatory agency personnel on relative risk at these training sessions and at project team meetings at installations have proven helpful in increasing regulatory acceptance of relative risk. DoD seeks to increase regulatory involvement in relative risk evaluations at all appropriate installations and formerly used defense sites.

**Q.5** *How often will field activities need to conduct relative risk site evaluations?*

- A.** Relative risk at sites should be evaluated whenever important new information about a site becomes available. DoD will collect information on site relative risk from the military services on a semi-annual basis, once in the middle of the fiscal year and once at year end.

**Q.6** *Will progress in the environmental restoration program be measured on the basis of Relative Risk?*



A. Yes, for the following reasons. Progress at sites in DERP has traditionally been measured by reporting on the response status of sites at the field and headquarters level (e.g., number of sites with responses complete). While these traditional measures of progress are still important measures, DoD planning guidance for Fiscal Years (FYs) 1998-2002 establishes goals for all military services to reduce relative risk at sites. The planning guidance specifically requires (1) military services to implement actions that lower relative risk for all high relative risk within specific time frames or have remedial systems in place where necessary for these sites, (2) implement actions that lower relative risk of all medium relative risk sites within a specific time frame or have remedial systems in place where necessary for those sites, and (3) implement actions that result in "response complete" for all relative risk sites within a set time frame.

*Q.7 Does relative risk site evaluation apply to sites at Base Realignment and Closure (BRAC) installations?*

A. Yes. DoD planning guidance requires that available restoration funds at BRAC installations be used to implement actions to lower relative risk for all high relative risk sites within specific time frames or have remedial systems in place where necessary for these sites.

*Q.8 What is the relationship between the Relative Risk Site Evaluation Framework and risk assessment?*

A. Relative risk evaluation and risk assessment share a common conceptual framework, but have significant differences in purpose and methodology. First and foremost, relative risk evaluation is not a substitute for a risk assessment. It is a

screening-level evaluation of site information at a point in time based on three factors: the contaminant hazard factor (CHF), the migration hazard factor (MPF), and the receptor factor. In terms of hazard assessment, the relative risk framework uses maximum (worst-case) contaminant data, while risk assessment uses average and/or reasonable maximum concentrations of contaminants. For exposure assessment, the relative risk framework relies on a qualitative evaluation of fate and transport of contaminants away from a source, while risk assessment emphasizes quantitative predictions of contaminant fate and transport. In terms of toxicity assessment, both relative risk and risk assessment use similar data. The relative risk framework uses concentration standards *derived from* preliminary remediation goals that are calculated using the same toxicity data used in risk assessment. In terms of results, relative risk information is used at the field level to help sequence work at sites. Risk assessment results are typically used to determine whether or not additional response actions are warranted at a site.

*Q.9 Why were the Environmental Protection Agency (EPA) preliminary remediation goals (PRGs) multiplied by 100 for carcinogens?*

A. PRGs are concentrations of contaminants in a specific medium that have been estimated to (1) cause 1 excess cancer occurrence per 1,000,000 people over the course of a 70-year life-time or (2) cause non-cancer adverse effects (e.g., birth defects, neurological problems). These values have been calculated through the use of toxicity data found in EPA databases and by using conservative assumptions (e.g., a person will obtain all water for drinking and showering over a 30-year period

from the same source). The methods used by EPA for calculating “safe” doses for cancer-versus-noncancer effects differ dramatically. Noncancer effects have thresholds (levels of exposure that do not cause toxicity), while cancer effects are not assumed to have a threshold. The differing assumptions for noncancer and cancer effects mean that respective toxicities are handled differently when setting acceptable exposures. For cancer-inducing agents, mathematical formulas are used to determine acceptable exposure levels. For noncancer toxicants, a “reference dose” that is related to the threshold is used. Threshold doses are generally much higher than are doses that cause 1 in 1,000,000 cancer occurrences.

In Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-30, dated 22 April 1991, the *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, EPA states that action is generally not warranted if reasonable maximum contaminant exposures at a site are less than the reference dose or cause fewer than 1 in 10,000 excess cancer occurrences. This is consistent with the remedial action threshold for carcinogens defined in the Preamble to the National Oil and Hazardous Substances Pollution Contingency Plan (55 Federal Register 8716, March 8, 1990). This means that EPA has made the reference dose equivalent to 1 in 10,000 cancer occurrences for screening purposes. Because PRGs are reference doses and concentrations of contaminants that result in 1 in 1,000,000 cancer occurrences, the PRGs for cancer agents are 100 times smaller than the equivalence set by OSWER Directive 9355.0-30. Multiplying the cancer PRGs by 100 restores the

equivalence for purposes of relative risk evaluation.

**Q.10** *What is the relationship between Maximum Contaminant Levels (MCLs) and concentration standards in Appendix B-1?*

- A.** MCLs, established by EPA under the Safe Drinking Water Act, apply to water supplies used for human consumption. Under the Comprehensive Environmental Response, Compensation, and Liability Act, as amended (CERCLA), MCLs are often considered applicable or relevant and appropriate requirements for groundwater response actions. Some MCLs are risk-based, while others are technology-based. When compared to concentration standards in Appendix B-1, results are mixed. For noncancer toxicants, concentration standards in Appendix B-1 are generally equivalent to or lower than MCLs. For cancer-causing agents, concentration standards in Appendix B-1 (equivalent to 1 in 10,000 excess cancer occurrences) are in some cases above MCLs and in others below MCLs depending in part on whether the MCL is risk-based or technology-based.

**Q.11** *Why is the threshold for the CHF rating of “significant” set at 100?*

- A.** The relative risk site evaluation framework is a programmatic tool used to categorize sites that have requirements for future work into three broad bands called “high,” “medium,” and “low.” In order to place the CHF in the appropriate perspective, it is important to note that neither the intent nor the application of relative risk evaluation is to classify risk in an absolute sense that defines what remedial action is required. Decisions regarding future work are made

separately on the basis of a remedial investigation, baseline risk assessment, and evaluation of the acceptability of the calculated risk. As stated in response to Question 16, a low overall site rating is not equivalent to a no further action decision. Thus, the descriptors used in the relative risk evaluation process such as “significant,” “moderate,” and “minimal,” as applied to the CHF ratios, and “high,” “medium,” or “low,” as applied to the overall site rating, must be considered relative terms to be used only in the relative rating of the sites under consideration. If there is insufficient data to categorize a site, it is identified as “Not Evaluated.”

The threshold values for the CHF descriptors were chosen as 2 and 100 such that when the site CHF was combined with the other site rating factors, an approximately equal distribution of sites among the three overall categories of “high,” “medium,” and “low” would result. This was determined by testing the framework with various values of CHF thresholds at thousands of DoD sites. Each of the three site-rating factors, which are based on the three elements of the conceptual site model used in a baseline risk assessment, are intended to have a balanced and appropriate impact on the final overall site rating. The balanced weighting of the three factors is illustrated (see Figure 7 in the Primer) by the fact that a “moderate” CHF will result in a “high” overall site rating if an “identified” receptor exists and the MPF is either “evident” or “potential.” Even with a “potential” receptor, a “high” overall rating will result if an “evident” pathway exists for a site with a “moderate” CHF. (Also see Question 13.)

**Q.12** *Does the Relative Risk Site Evaluation Framework consider wetlands as an ecological receptor?*

- A.** Wetlands, in the broad sense of the definition, are present at a large number of DoD sites. As a result, maximum resolution of sites on the basis of relative risk to human health and ecological receptors is obtained by considering wetlands as ecological receptors when they are part of sensitive environments such as critical habitats, marine sanctuaries, spawning areas, and other such environments listed in Table 2 of the Primer.

**Q.13** *What is the rationale for the assignment of ratings to the 27 combinations of the three factors used in the Relative Risk Site Evaluation Framework?*

- A.** The bottom line answer is that for relative risk site evaluation to be a useful programmatic tool, it had to result in placing a significant distribution of the evaluated sites into each of the three broad categories of “high,” “medium,” and “low.” The thresholds for each category were established by evaluating data from all the services to ensure that there would be a distribution of sites into each category. The choices of categories for the 27 possible combinations of the three different site characterization factors (depicted in Figures 3 and 7 of the Primer) are based on a balanced consideration of the three factors as they describe the degree of completion of exposure of receptors to contaminants. The logic of the assigned categories is perhaps best understood by considering the combinations depicted in Figure 7 of the Primer in light of the exposure scenarios represented by each of the 27 possibilities.

With a significant CHF, which represents a concentration of contaminant that is two orders of magnitude above the concentration standard (see Appendix B of the Primer), any combination of evident or potential migration pathway with an identified or potential receptor is assigned to be in the high category. Any potential for exposure to contaminants at this high relative concentration will receive highest priority. Only if either the migration pathway is confined (no migration to a point of exposure) or the receptors are limited (little or no receptor access to site) is the site placed in a medium category. If both migration is unlikely and receptor access is unlikely, the site is assigned a low rating. In this case, the contaminant, though present at high concentrations, will not be exposed to receptors and can await cleanup while other sites with a more certain scenario for exposure are addressed.

Sites with a moderate CHF, where concentrations of contaminants exceed concentration standards by factors of 2 to 100, also receive high ratings if migration is evident and receptors are identified, if migration is evident and receptors are potential, or if migration is potential and receptors are identified. These situations all represent likely exposure scenarios to concentrations of contaminant that exceed the concentration standards by more than a factor of 2. If both the migration and the receptors are potential, exposure is less likely and a medium rating is assigned. If migration is evident, even if the receptor is judged to be limited, a medium rating is also assigned to allow for the existence of an unanticipated receptor. In the case of confined migration (no migration to a point of exposure), all receptor possibilities are assigned a low rating because exposure

is unlikely. The combination of potential migration and limited receptors is also assigned a low rating.

With a low CHF, where measured concentrations are less than twice the concentration standard, only sites with both evident migration and identified receptors are assigned a high rating. A high probability of exposure, even to this relatively low concentration, received the highest priority. Evident migration with potential receptors or potential migration with identified receptors both receive a medium rating because of the likelihood of exposure, albeit to a relatively lower concentration of contaminant. All other possibilities with this relatively lower concentration of contaminant receive a low rating.

***Q.14 What happened to the Defense Priority Model (DPM)?***

- A.** In 9 November 1993, testifying before the Senate Committee on Energy and Natural Resources, Sherri Goodman, Deputy Under Secretary of Defense (Environmental Security) stated the following: "...concerns have been raised about the use of DPM for determining program priorities and DoD has decided not to use the model on a DoD-wide basis."

***Q.15 How does the Relative Risk Site Evaluation Framework relate to the Hazard Ranking System (HRS)?***

- A.** Both the HRS and evaluation framework are screening tools that can be used to evaluate relative risks at waste sites. The HRS is an EPA regulation (40 Code of Federal Regulations 300, Appendix A) used to place sites or aggregates of sites on the National Priorities List (NPL) if scores are above 28.5. Although the HRS has the capability to differentiate among the

relative risk of sites, it is more frequently applied to identify candidate installations for the NPL. The relative risk framework is a tool used to group sites in high, medium, and low relative risk categories to help sequence work at installations or former defense sites given the available resources. The HRS evaluates groundwater, surface water, soil, and air pathways and considers human and ecological receptors (called targets). Each pathway in the HRS is evaluated using three factor categories (likelihood of release, waste characteristics, and targets) each of which is subdivided into a number of factors tied to site-related information. The relative risk framework evaluates groundwater, surface water, and surface soils and considers human and ecological receptors. Both the HRS and relative risk use toxicity data from EPA databases for assessing contaminants; however, only the HRS takes waste quantity into account. The HRS assigns a single score to a site between 0 and 100 from a one-time ranking that becomes permanent. The relative risk framework assigns a site a high, medium, or low rating at a point in time, but allows for re-evaluation of a site when important new information becomes available. HRS ranking is detailed, time-intensive, and requires significant support documentation. In addition, HRS evaluations are typically not specific to sites when applied to military installations. HRS evaluations are based on an aggregation of sites across an installation. Relative risk evaluation is simpler and more transparent than HRS evaluation, is applied site by site, but is subject to more judgment.

***Q.16*** Will “low” relative risk sites be addressed or will they be deferred indefinitely?

**A.** A low relative risk site is not equivalent to a no further action site. Appropriate response actions will be programmed for all low relative risk sites as dictated by available resources and other risk management considerations.

***Q.17*** Does the Relative Risk Site Evaluation Framework apply to ordnance and explosive wastes?

**A.** The relative risk evaluation framework applies specifically to hazardous, petroleum, and radioactive waste sites in the environmental restoration program. A separate methodology has been developed for grouping ordnance and explosive waste sites into high, medium, and low categories. This methodology is based on safety concerns, and results are tracked separately from other sites.

***Q.18*** When are relative risk site evaluations not performed?

**A.** Relative risk site evaluations are not required at sites classified as (1) having “all remedies in place,” (2) “response complete,” (3) lacking sufficient information, or (4) abandoned ordnance. These four situations are discussed in section 1.4 of the Primer.